

The fall of ESO repricing: Governance reform or reform gone awry?*

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Abstract

Repricing is strongly opposed by active institutional investors and corporate governance reformists, who regard it a bad governance practice. This hostility, coupled with unflattering press and unfavorable changes in repricing accounting mandated in 1998 have made repricing virtually extinct today. Our empirical evidence makes it difficult to rationalize this angst over repricing. We show that firm-wide repricing costs are quite modest and the portion relating to executive options even more so. These costs are further moderated by vesting period changes that we find are often associated with repricing. The push away from repricing has led firms to use other tools for handling underwater options, prominently the strategy of making “refresher” grants in lieu of repricing. We show that this is a change for the worse that replaces repricing with an inferior alternative with deadweight losses that benefit neither the shareholders of repricers nor the repriced employees. For instance, using refresher grants in lieu of repricing cost shareholders of Microsoft Corporation between \$700 million and \$2 billion in April 2000. While the demise of repricing may be positively viewed by its opponents, it appears to be an economically misguided change.

1. Introduction

Repricing is the practice of lowering the strike prices of previously granted employee stock options. Firms usually reprice after a period of significant stock price declines that renders stock options “underwater” or out-of-the-money. The practice of repricing has been controversial. Firms contend that underwater options have little motivational value and offer poor retention incentives. Thus, not repricing underwater options could lead to high employee turnover. On the other hand, critics of repricing, most prominently activist institutional investors, contend that it is a bad governance practice because it confers rewards upon managers after a period of poor stock price performance, conditions under which managers should be penalized instead. Fueled in large part by such concerns, the Financial Accounting Standards Board (FASB) changed the accounting treatment of repricing. FASB required that all options repriced after December 1998 should be expensed as a charge to accounting income, while non-repriced options could continue to be merely footnoted in financial statements. Not surprisingly, firms have shied away from repricing after this accounting change.

Figure 1 illustrates the nature of the drop off in repricings. After holding steady through the mid-1990s, the number of repricers sharply drops in fiscal 1999, and repricing becomes almost extinct since then. The precipitous drop in repricings in fiscal 1999 and thereafter is especially dramatic because it comes on the heels of the severe bear market in the late 1990s, which leads to more options going underwater. This condition should normally lead to an *increase* in repricings, yet repricings have faded away. Thus, the practical effect of the 1998 FASB ruling and the opposition to repricing by activist institutions is to bring into effect a regime in which repricing is all but eliminated.

The eclipse of repricing has taken away from firms one tool for dealing with underwater options. However, firms still continue to grant options, so the underlying problem that precipitates repricing, i.e., options going underwater, remains. What else could firms do when confronted by underwater options and repricing is not feasible? A number of recent papers document that firms facing underwater options make new “refresher” option grants in lieu

of repricing. Ittner, Lambert, and Larcker (2002) find that this is the preferred strategy in a proprietary sample of new economy firms supplied by iQuantic Inc. Murphy (2003) makes a similar point for new economy firms included in the EXECUCOMP database. Hall and Knox (2003) also report that refresher grants represent the preferred route for handling underwater options in broader EXECUCOMP samples. Chen (2004) presents related evidence in an interesting and different experiment by analyzing firms that explicitly adopt charter provisions prohibiting repricing. Chen finds that repricing-constrained firms also deal with underwater options by making refresher option grants in lieu of repricing. Thus, restricting repricing essentially moves firms to a regime in which refresher option grants substitute for repricing of underwater stock options.

While the demise of repricing and its replacement by refresher grants is now empirically well-documented, a key question is whether firms' shareholders are better off for this regime change. The reaction of institutional shareholders and governance reformists certainly suggests that this is the case. In 2003, New York Stock Exchange raised the bar on repricings, required listed firms to seek specific shareholder approval before initiating repricings. Influential voting advisories by Institutional Shareholder Services recommend voting against repricing. Governance indexes count the ability to reprice options as an attribute of *poor* corporate governance, suggesting that firms are better off in a world without option repricing. Is this really the case? We provide some rather sharp results to the contrary: firms are probably *worse off* in the current no-repricing regime. We present empirical evidence that repricing costs to shareholders have been quite modest historically, and the portions attributable to executives even more so. Using refresher grants in lieu of repricing is an inferior Pareto dominated strategy, creating deadweight costs that benefit neither the repricing firms' shareholders nor the repriced employees. Thus, elimination of repricing, however well intentioned, is economically misguided, an example of governance reform gone awry.

Our analysis is organized into three parts. Part 1 develops empirical evidence on repricing costs, using a new hand-compiled dataset on executive stock option (ESO) repricing covering 197 repricing announcements between 1992 and 1997 involving over 1,000 repriced executives

and 2,500 repriced option series. Despite the widespread discussion and criticism of repricing, there has been little evidence on the firm-wide net costs of repricing. A key difficulty is that existing literature, drawing on data reported in repricing tables in proxies and coded by EXECUCOMP, focuses on repriced options of executive officers only. An open question is whether repricing is primarily an executive-only phenomenon, or whether the event more typically relates to firms with more broad-based option plans with significant flows to lower ranked employees. We find evidence for the latter view. Non-executive employees are the major recipients of repriced option flows in our sample, accounting for 72% of all options repriced in our sample firms.

The terms of repriced options represent the other determinants of repricing costs. As in previous work, we find that repricing usually entails a significant 40% downward revision in option strike and frequently also a maturity extension, although firms sometimes pull back some of the value given away in repricing by granting less than one new option for each old option canceled. Incorporating these changes and the flows to executives and employees, we develop estimates of total repricing costs at a firm-wide level. While the dollar value of option grants given in repricing is high, so is the dollar value of the options surrendered in repricing. As we show, the value of surrendered options is significant because options tend to be repriced early in the grant cycle when there is significant remaining maturity. The upshot is that the net repricing cost, the value of grants minus that of surrendered options, is rather modest. The net cost amounts to about a quarter of the value of repricing grants and 0.4% of the market value of the repricing firm on average. These costs are further moderated by the fact that fresh vesting periods are imposed on repriced options, as we document here. The low costs of ESO repricing, coupled with the fact that most repricing flows are directed at non-executive employees, suggest that executive rent expropriation is an unlikely first order characterization of announced repricings. Our evidence makes it hard to reconcile the angst of institutional investors over ESO repricing.

Part 2 of our paper analyzes the valuation and incentive effects of repricing when viewed through the lens of repriced employees rather than the repricing firm. Employee discounting

of stock options is significant, so the “subjective” value of stock options to employees is well below its Black-Scholes cost to firms. More importantly for our purpose, the discount increases as options go out of the money. There are similar differences between incentive measures as measured by the Black-Scholes approach versus measures based on subjective valuation models. We show that the subjective-objective value wedge is exacerbated when we incorporate the American feature of employee stock options. We illustrate the extent of subjective discounting by presenting data from an underwater option exchange program offered by Microsoft Corporation to its employees through J P Morgan.

Part 3 of our paper compares repricing to the strategy of giving refresher grants in lieu of repricing. We show that the refresher grant strategy is strictly costlier than straight strike reset repricing even when we hold constant the subjective value (or incentives) of each alternative to the repriced employee. Thus, repricing strictly dominates such refresher option granting strategies, because these strategies impose deadweight costs that benefit neither the shareholders nor the employees of repricing firms. We illustrate the economic magnitude of such losses by analyzing the specific case of Microsoft Corporation, which chose not to reprice but instead make a refresher grant of 0.5 new options for each old option in April 2000. We estimate that the deadweight loss is quite large: Microsoft shareholders lost between \$700 million and \$2.1 billion as a result of choosing the refresher grant strategy in lieu of straight repricing.

The paper proceeds as follows. Section 2 briefly reviews the literature on ESO repricing to place our paper in the perspective of received evidence. Section 3 discusses the data and some new evidence on vesting period resets that further moderate repricing costs to firms. Section 4 analyzes the flow of repriced options over the firm’s hierarchy and estimates firm-wide net costs of repricing. Section 5 examines the subjective value of repricing to repriced employees. Section 6 discusses compares repricing with quiet repricing via refresher grants. Section 7 concludes.

2. Data

Our repricing sample is based on Standard & Poor’s 1998 EXECUCOMP database, which contains information for 51,555 executives for 1,836 firms for fiscal year 1992 to fiscal year 1997. From this database, we begin with the instances of repricing identified by Chidambaran and Prabhala (2003). Between fiscal 1992 and fiscal 1997, EXECUCOMP identifies a total of 864 executives who are repriced, which translates into 240 separate firm-level repricing announcements. As discussed in Chidambaran and Prabhala, 29 of these are discarded because of incorrect coding or because the repricing is technical in nature. In addition, we discard 12 cases for which we could not get sufficient data for our empirical analysis either from disclosures in the repricing year or the year after. This leaves us with 197 executive stock option repricing events with matching firm and executive data in EXECUCOMP. Table 1 reports the annual breakdown of repricings in our sample. Repricing seems to have become more popular over time. There are 13 repricing events in fiscal 1992, a peak of 51 events in fiscal 1996, and 36 events in fiscal 1997.

For each repricing event, we hand-collect data from repricing tables and supplement it with other information in the proxy statements or 10-K’s as described below. To obtain the number of executive options repriced, we read repricing tables from the proxy statement in the repricing fiscal year proxy or the subsequent year. The tables give the name of each repriced executive, which we match with the EXECUCOMP database to ascertain whether the executive was among the top 5 compensated employees of the repricing firm. Each executive can have several option series with differing strikes and remaining maturities, which we extract from the repricing tables. In two cases, proxies do not give the information for every option series repriced but instead give a range of values. For these cases, we set the pre-repricing strike price of the option to be at the high end of the range and the maturity at the low end of the range. This choice biases our findings towards overstating repricing costs to the firm. Excluding these cases has no material effect on our results.

Firms sometimes grant fewer number of new options compared with the number of options canceled. This information is often provided in the repricing tables or the footnotes to the grants table, but it is some times necessary to read through the more broad compensation disclosures in the proxy tables to get the new-for-old exchange ratio. We also read through proxy statements to identify whether the repriced options have a new vesting period or contain related exercise restrictions contingent on continuation of employment with the repricing firm. Finally, we obtain data on repriced options for employees ranked below the executive officers of the repriced firm where this information is explicitly disclosed, by reading the text of the proxies or 10-K's. From the section reporting the stock and flow of options in the 10-K's, we also collect data on the number of options outstanding in the year prior to repricing, granted, exercised, and canceled in the repricing year, and outstanding at the end of the repricing year. As we discuss later in Section 4, the flow of options data can be combined with data from the repricing tables and the option grant tables in the proxies to infer the total number of options repriced by the firm for the cases where this figure is not directly disclosed by the company.

The initial sample extracted from the repricing tables has 3,345 option series relating to 1,574 repriced executives and 274 firms. We eliminate 636 option series for 367 executives and 51 firm-years pertaining to periods before 1992 and 168 option series relating to 82 executives and 24 firm-years that had no match in EXECUCOMP. Eliminating these leaves us with 2,538 option series relating to 1,127 executives and 197 firms. Of this sample, 816 executives with 1,845 repriced option series have compensation data in EXECUCOMP. The number of option series repriced per executive ranges from one to 13 with median equal to two and mean equal to 2.28. We supplement the repricing table data with return information from the Center for Research in Security Prices (CRSP) to calculate volatility, which is an input required for option valuation and obtain firm characteristics from the COMPUSTAT database.

2.1 Terms altered in repricing

Brenner, Sundaram, and Yermack (2000) and Chance, Kumar, and Todd (2000) report that in their samples of ESO repricings, firms lower option strike prices by an average of 40%, and sometimes also extend the maturity of the repriced options. Table 2 reports similar results for our sample. Consistent with earlier literature, we find that the median (mean) decline in strike price is 42.5% (41.7%). In 176 cases, proxies or the 10-K's explicitly state whether the maturity is extended or not. Of these, 86 repricings (49%) have no maturity extension, while maturity is extended in 90 repricings (51%). The median (mean) maturity of the options prior to repricing is 8.00 (7.13) years while it is 9.40 (8.26) years after repricing. The median (mean) change in maturity when the maturity is extended is 1.3 (1.93) years. The important point is that options are repriced fairly early in their life cycle and maturity extensions, where made, are modest relative to the remaining maturity of the repriced option. In 45 repricings (23%), firms reduce the number of new options that are granted in exchange for the old out-of-the-money options. The average exchange ratio in these cases is 67%.

In reading repricer disclosures, we also found that firms often restart the vesting period or impose related restrictions on the exerciseability of the option grants tied to the employee remaining with the repricing firm. Because this aspect of repricing has received less attention in the literature, we describe it in greater detail. Restarting vesting is rather frequent. In 179 cases, repricing disclosures mention whether vesting restarts are imposed or not. In 120 of these cases, or 67%, firms restart vesting. The restart offers two advantages to the repricing firm. One is that it gives the repricer the option to terminate the repriced employee in the future without the overhang of already vested options. In addition, it is a bonding mechanism, a golden handcuff, to retain the repriced employee, who must now risk forfeiture of the (unvested) repriced option should she choose to leave the firm after repricing. The high frequency of vesting restarts suggests that employee turnover should fall after repricing. This implication is consistent with reduced employee turnover, as evidenced by fewer option

cancelations, after repricing (Carter and Lynch (2004)). Our evidence suggests that vesting resets could explain why employee turnover falls after repricing.

We also conduct a cross-sectional analysis of the decision to restart vesting. Whether the vesting period is restarted or not should depend on the importance of retaining human capital in the repricing firm. Technology firms, in particular, faced shortages of human capital in the 1990s, as argued by Carter and Lynch (2001). Human capital is also most important for firms in this sector. Thus, technology firms should be more likely to restart the vesting period after repricings to create “golden handcuffs” for better employee retention. Similarly, firms that experience CEO turnover, whether for disciplinary reasons or because CEOs departed for better opportunities, should be more likely to restart vesting to stop further losses of human capital. Hence, CEO turnover should be positively related to the probability of vesting restarts. To the extent small firms and younger firms should be more likely to face greater costs of employee turnover, firm size and age should be negatively related to the decision to restart vesting. From the viewpoint of controlling repricing costs, firms that reprice all employees rather than a few executives alone, firms that experience greater strike price revisions, and those extending maturity of their options should be more likely to restart their vesting periods.

Table 3 analyzes differences between firms that restarted and did not restart their vesting periods. Firms that restart vesting periods tend to have experienced greater price drops, which suggests that more favorable revisions in terms are likely to be associated with vesting restarts. Similarly, maturity extension is also positively related to vesting restarts. It appears that options with new maturities are regarded as “fresh” grants that can then be subject to new vesting restrictions. Vesting period restarts are also significantly more likely to be associated with employee-wide repricing rather than executive-only repricing. Consistent with a human capital retention motive, vesting restart firms are more likely to have experienced CEO turnover and to belong to the technology industry sector. Firms restarting vesting periods also tend to be smaller, consistent with the argument in Carter and Lynch (2001) that smaller firms find it harder to replace human capital. There is no significant difference

in the age of firms that restart vesting periods relative to those that do not restart vesting. Table 4 presents estimates of a multivariate Probit specification, in which the dependent variable is 1 if the vesting is restarted and zero if not and the independent variables include the characteristics analyzed in Table 3. Five of the variables in Table 3 are significant in the multivariate specification in the direction suggested by the univariate differences. Firm size has the right sign but is not significant, while strike price revision, maturity extension, CEO turnover, technology, and employee-wide repricing dummy variables are significant determinants of the decision to impose fresh vesting restrictions at the repricing date. The results are broadly consistent with the idea that firms with greater human capital needs are more likely to restart vesting at repricings.

3. Firm-wide costs of repricing

This section reports empirical evidence on costs of ESO repricings to firms' shareholders. Much of the existing evidence on repricing focuses on *executive* options repriced, data for which are reported in repricing tables in proxies. Less is known about repricing flows to rank-and-file non-executive employees. We develop evidence on totality of repriced option flows both to executives and non-executive employees and show that the latter dominate. Even after incorporating the non-executive employee option flows, we show that repricing costs remain modest. The upshot is that repricing costs are modest, the portion attributable to executives even more so, and these costs are moderated by vesting restarts common to ESO repricings. Our evidence makes it difficult to understand the outcry raised by institutional investors over ESO repricings in the 1990s.

3.1. *Number of options repriced*

We use two routes to determine the total number of options repriced for both executives and employees. First, we check whether this figure is directly disclosed in proxies or 10-K's.

Such disclosures are not mandatory, but often form part of the footnotes to repricing tables, footnotes to compensation tables, reports of the compensation committee, or the sections that describe stock option and incentive plans of the firm in 10-K's. This process give the total number of repriced options for the firm for 134 repricing events. In 3 of these cases, the executives appeared to be the only employees repriced, so we set the firm-wide number of options repriced to be equal to the executive options repriced.

If we cannot find the total number of options repriced directly by reading repricer disclosures, we develop alternative estimates by appealing to potential differences between options reporting in proxies and 10-K's. The section of annual 10-K's giving stock option or incentive plans of firms reports the stock and flow of incentive options for each fiscal year. From this report, we extract the number of options granted firm-wide in the repricing year. A second source of grant information is the proxy statement (and EXECUCOMP), where the option grants table gives the number of options granted (say g) to an executive and the percentage this represents of the total number of options granted by the firm in the fiscal year (say p). As in Core and Guay (2001), g/p is a proxy statement based estimate of the total firm-wide option grants in the repricing year.

The one complication with the g/p figure is that it sometimes includes and sometimes excludes repriced options, and the reporting conventions are not standard across firms. We read the footnotes to the grant table to infer whether this figure includes only new option grants or new grants plus options regranted as part of the repricing. If one of the two sources of grant information includes repriced options while the other does not, their difference provides an estimate of the number of repriced options for the firm. For example, consider the case of ACC Corp which repriced options in 1994 but does not directly disclose the number of options. ACC Corp discloses in its 10-K filing that the firm granted a total of 665,100 options in 1994. Based on disclosures in the proxy statements, the total new option grants for the firm to be 431,035. The difference, 223,965, is then the number of options that are part of the cancel and regrant repricing program. We are able to determine the total number of repriced options for 15 firms using this approach.

For the remaining firms neither the annual statement nor the differential between proxies and 10-K's reveals the number of options repriced. For these firms, we examine the canceled options figure in the section on stock and flow of incentive options in the 10-K's. Firms that treat repricing as a cancelation and regrant (rather than just an alteration of terms of old options) report repriced options as part of both the grants and cancelation figures. In such cases, the canceled options figure represents an estimate of the number of options repriced. This figure needs to be deflated because option cancelation can occur for reasons other than repricing (e.g., resignations). We set the total number of options repriced to be equal to 73% of the total number of canceled options. This is the average of the ratio of repriced options to the total number of canceled options for the 149 other repricing events for which both data are available. This method yields an estimate of the number of repriced options for 33 firms, bringing the total number of firms for which this field is available to 182. For the remaining 17 firms in our sample of 197 ESOs, the available data is not sufficient to estimate the number of options repriced. For these firms, the firm wide number of repriced options is not included in the grant or canceled options nor is it explicitly disclosed in the annual financial statements of the repricers.

Table 5 reports estimates of the number of repriced options. For executives, the number of options repriced is the sum of repriced options in the repricing tables. The below-executive ranked employees' repriced options is the difference between the firm-wide and executive options repriced. We normalize the number of options to make them comparable across firms with options at different strike prices. For instance, one at-the-money option for a \$25 stock price firm is worth 25 times one at-the-money option for a firm with stock price equal to \$1, so it makes little sense to compare the number of options repriced between these two firms. To make the number of options comparable across firms, we multiply the number of options repriced for each firm by its stock price at the repricing date and divide it by 10, so that option strike prices and stock prices are made equal to \$10.

From Table 5, we see that repriced options flow primarily to non-executive employees. In the median repricing, two-thirds of repriced options flow to non-executive employees. For

an alternative metric, add all options repriced across all executives for all repriced firms and divide by the sum of total options repriced for all firms. This estimate gives the proportion of the aggregate options repriced in our sample that go to employees. We find that executives get about 28% of all options repriced, while 72% of options repriced flow to employees below. These findings reveal little evidence that repricing is an executive-only phenomenon. Rather, repricers tend to be firms with more broad based option granting plans (Core and Guay 2001) and repricing flows are primarily directed at lower ranked employees. It is important to note that 72% is a *lower* bound on the flow of repriced options to employees because the estimate is based on announced *executive* stock option repricings. There are also repricings in which executives are specifically excluded as beneficiaries. These repricings cannot be readily identified because firms need not disclose repricing tables for non-executive repricings (Carter and Lynch 2001). Incorporating these non-executive repricings would reinforce our main point that repriced options flow mainly to non-executive employees of repricers.

3.2. *Black-Scholes costs of repricing*

Table 6 reports data on Black-Scholes costs of repricing for our sample. The inputs for implementing the Black-Scholes formula are as follows. Terms of repriced options come from the repricing tables. In two cases, a range of strike prices is reported for all repriced options: in these cases, we pick the highest old strike price so as to produce the highest possible repricing costs. New maturities are given explicitly in the repricing tables and sometimes in the text of the repricing disclosures. In the cases where firms grant less than one new option per canceled option, the number of new options granted is reported in the repricing table, or an overall exchange ratio is reported in the proxy statement, which we apply to all repriced options. The Black-Scholes formula also needs an input of the riskless rate and volatility. For the riskless rate, we use the 10-year treasury rates prevalent on the repricing date. Our volatility estimates are based on 250 daily returns prior to the repricing date.

We are able to compute repricing costs for 946 executives. Column 2 in Table 6 shows data on a per executive basis; the remaining columns in Table 6 give per firm estimates. The executive data are broken up into two categories: highest compensated executives for whom compensation is reported in proxies (and coded by EXECUCOMP) and other executive officers who cannot be matched with EXECUCOMP data. Column 5 sums across both types of executives. The last column reports repricing costs on a firm-wide basis, incorporating options of non-executive officer employees who are also repriced. To go from executive level data to firm-wide data, we multiply the executive level figures by the ratio of the number of options repriced firm-wide to the number of options summed across all executives. The results in Table 6 make two major points. First, all firm-wide estimates significantly exceed executive-only estimates. For instance, the median Black-Scholes value of the surrendered options on a firm-wide basis is \$4.38 million, over three times the median Black-Scholes value of options surrendered by executives (\$1.34 million). This is not surprising. Following Section 5.1 and Table 5, most repriced options flow to lower ranked employees, who therefore account for the bulk of the Black-Scholes value of options involved in repricing. The second point emphasized by Table 6 is that the net costs of repricing are relatively modest in relation to value of repricing grants. On a firm-wide basis, the median (mean) value of the new grants involved in repricing equal \$5.6 million (\$12.3 million) but net costs remain modest with median (mean) of \$1.1 million (\$2.4 million). Net costs are less than a quarter of the grant values on average.

What explains the rather modest costs of repricing? The intuition for the relatively low costs comes from the long remaining maturity of repriced options. When an option's maturity is long, the value of the option comes mostly from the option's time value. The intrinsic value or "moneyness" of the option contributes little to the total option value, a theoretical point also made by Jin and Meulbroek (2002). For instance, using volatility of 40% and riskless rate of 5%, a 10-year at-the-money call on a stock trading at \$60 has Black-Scholes value of \$36.09. If the stock price drops by 40%, the option becomes worth \$28.20, so the out-of-the-money option thus retains more than 78% of the value of the at-the-money

option. On the other hand, a short maturity options that is 40% out-of-the-money could be practically worthless. To illustrate this point, if the option maturity in the above example were 3 months to maturity, the 40% out-of-the-money is worth only 6% of the value of the at-the-money option.

Thus, in theory, the key factor in assessing repricing costs is whether repriced options have short or long remaining maturity. This is ultimately an empirical question to be resolved by analyzing data from firms that actually repriced. In our sample, the median remaining life of repriced options is 8 years compared to grant maturity of 10 years. Options are thus repriced fairly early in their grant cycle when they have long remaining maturity. At this stage, the repricing-induced change in option value is modest.

3.3. Summary

Our results have implications for the current literature and the broader debate over repricing. The first message of our results concerns repricing costs. Our repricing cost estimates are ten times the only other estimates we are aware of, i.e., Chance, Kumar, and Todd (2000). The difference is due to the repriced options flow to lower ranked employees. Even after incorporating these flows, however, our point is that repricing costs remain modest relative to firm value, 0.4% on average. Empirically, past repricings just do not seem to have been especially burdensome cost to shareholders and most of these costs are anyway incurred for non-executive employee options. The governance concerns that repricing has evoked seem rather overblown in relation to its economic costs to shareholders.

Our results also have implications for current proposals by active investors to eliminate or restrict repricing. These proposals are usually offered as part of the drive to improve corporate governance. Our results point out that the brunt of such proposals is likely to be borne by non-executive employees, since these employees are the primary beneficiaries of repricing. It seems unlikely that no-repricing advocates wish to micro manage and bear the

consequences of not repricing non-executive employees, but this is likely to be an unwitting consequence of restricting repricing.

4. Subjective value of repricing to employees

The literature on employee stock options points out that there could be significant differences between the cost of repricing to firms and its “subjective” value to employees. The wedge arises because employees face restrictions on selling company stock to hedge their option exposure, and therefore have suboptimal portfolios with excessive exposure to the idiosyncratic risk of the option-granting firm. Hall and Murphy (2000), Meulbroek (2001), and Ingersoll (forthcoming) offer models for the subjective valuation of stock options (see also DeTemple and Sundaresan, 1999). We adopt the Ingersoll model to compute the subjective value and incentives of stock options and the changes in these engendered by repricing. Ingersoll shows that the subjective model of options can be obtained through a downward adjustment to the Black-Scholes formula. The downward adjustment is a function of employee risk aversion, the idiosyncratic volatility of the stock, and the proportion of executive wealth tied to the repricing company’s stock. An advantage of Ingersoll’s model is that it permits fairly straightforward and intuitive comparative statics of the subjective value with respect to these parameters. The model also lends itself readily (though in a computationally more cumbersome way) to modification to incorporate the American feature.

4.1. *European option valuation*

Table 7a reports the Ingersoll (forthcoming) subjective value of options before and after repricing as well as the change in subjective value for our sample of repricers. Our baseline case estimates are based on an assumption that managers have a constant relative risk aversion utility function with relative risk aversion equal to 4 and that 25% of the managers wealth is tied to the repricing firm’s stock price. We examine the sensitivity of these estimates

to assumptions about these parameters in Table 8. We use a historical volatility estimate and we obtain the idiosyncratic volatility as the residual variance in a market model. The beta of the stock for the market model is obtained by regressions using 30 monthly returns prior to the repricing fiscal year. As in the estimates of Black-Scholes value, we report the estimates per executive, across all named and other executives, and on a firm-wide basis.

Our sample of repricers shows relatively high idiosyncratic volatility, with a median residual variance equal to about 85% of total variance of stock returns. This is not surprising given that repricers are small, young firms with an industry concentration in service, technology, and trade sectors. Thus, executives holding stock or options in repricing firms are exposed to significant idiosyncratic risk. As a consequence the empirical estimates of subjective option values display significant discounting, greater than in the numerical examples in Ingersoll (forthcoming). Given that the subjective values of options are significantly lower than the option Black-Scholes values, the dollar changes in subjective option value from repricing are also smaller than the changes in Black-Scholes values. The key finding, however, is that the percentage changes in subjective value due to repricing are greater than the Black-Scholes values. This difference reflects the fact that subjective values decline more rapidly than Black-Scholes option values. For instance, in Table 7a, the firm-wide median percentage change in subjective option value is 46%, almost double the estimate of 24% under the Black-Scholes approach.

Table 7b reports the incentive effects, or changes in “delta,” caused by repricing. We compute delta as the change in subjective option value for a \$1 change in stock price. Column 2 of the table reports the delta before and after repricing as well as the absolute and percentage changes in delta due to repricing. We also report the corresponding Black-Scholes figures for comparison. The patterns in Table 7b are similar to those in Table 7a. Subjective deltas and dollar changes in these are considerably lower than their Black-Scholes counterparts. The percentage changes are higher, reflecting the fact that incentives drop off rapidly as options go out of the money. Table 8 shows that the changes in results for other

parameter configurations. The percentage changes in subjective value and delta increase as executives become more risk averse or have more wealth tied to the underlying stock.

4.2. Incorporating the American feature strengthens our results

Employees often exercise ESOs early, which reduces the effective maturity of these options (Bettis, Bizjak, and Lemmon, forthcoming) and this feature can be priced, as discussed in Ingersoll (forthcoming). Our results with respect to subjective discounting and its variation between at the money and out of the money options are qualitatively similar when we incorporate the early exercise feature in options. One approach towards incorporating the American feature into subjective option valuation is to make an ad-hoc adjustment to option maturity. We reestimate option values and incentives using a maturity of 5 years. The results remain qualitatively similar: there is significant subjective discounting of options and this increases as options are more out of the money, so the percentage change in option value or incentives increases as options go more out of the money.

Ingersoll (forthcoming) provides a formal approach to handle the American feature is to directly incorporate the early exercise feature into the subjective valuation model. While we do not report detailed tables with these results, our main finding is that the results strengthen under this approach. Specifically, the differential in discounts for out of the money options and at the money options increases when incorporating the American feature. The intuition is not hard to see. Early exercise is more likely for at the money options, so incorporating this feature adds more value for at the money options. On the other hand, out of the money options are less likely to be exercised early, so the American feature matters less for these options. Thus, adding the American feature increases the value of at-the-money options relatively more. The implication is that the value change when options are reset from being out of the money to being at the money is greater for American options rather than European-style options.

We also note that adding the American feature reduces the cost of repricing to firms. To see why, observe that the optimal exercise policy for calls on non-dividend paying stocks is to never exercise early. Thus, early exercise reduces the cost of option grants to the firm. The implications for repricing are clear. At the money options are more likely to be exercised early while out of the money options are not. Therefore, firms that reprice recoup some of the costs of repricing because the new at the money option is more likely to be exercised early while the canceled option is less likely to be exercised early. Hence, the percentage change in option value to the repricing firm is lower when we incorporate the American feature into our analysis. On the other hand, the American feature increases the percentage change in subjective value to employees. Therefore, the wedge between firms' costs and subjective value of repricing widens when we add in the American feature.

4.3. Microsoft 2003: Some evidence on subjective discounting

In June 2003, Microsoft Corporation launched a plan to buy out its underwater options through a tender offer by J P Morgan, which was consummated in December 2003. We analyze data from this tender offer because it offers some of the first empirical evidence on the nature of the subjective discounting of employee stock options.

Our approach is to compare the Black-Scholes value of the options surrendered in the exchange offer with the prices that employees received for their surrendered options. For this purpose, we need data on the terms of options surrendered such as strike prices and maturities as well as the price schedules for these surrendered options. We extract this information from several documents filed in connection with this transaction include Form SC-TO-I, a tender offer statement on October 15, 2003 and subsequent amendments to this statement, a prospectus under rule 424 (b)(2) dated October 24, 2003 and related supplements, the 10-Q's around the transaction dates, and contracts that Microsoft signed with J P Morgan related to this transaction. These documents show that options having strike prices of \$33 and above were eligible for surrender. Unfortunately, the complete schedule of prices negotiated

by Microsoft with J P Morgan for the surrendered options is not disclosed, nor is the schedule of options surrendered at the individual employee level. Thus, there are not enough data to analyze discounting and its variation at the individual employee level, but aggregate data are made available through company disclosures, and these provide some insight into the subjective valuation of options by employees.

A total of 621.4 million options held by 36,539 employees were eligible for surrender. Of these, 344.6 million options held by 18,503 employees were tendered to J P Morgan, who paid \$382 million for these options. \$219 million was paid to employees before December 2003, with the rest to be held by Microsoft and paid with interest over the next two years contingent on the employee continuing to be employed by Microsoft and reveal the nature of subjective discounting of options by employees. The 10-Q for the quarter ended December 2003, which was filed on February 6, 2004, also reveals that the surrendered options had strike prices ranging from \$33.03 to \$59.56. Against this, Microsoft's closing price on the date of consummation of the deal, December 8, 2003, was \$ 26.24. These data can be used to price the surrendered employee stock options using the Black-Scholes approach, while the price paid by J P Morgan indicates the subjective valuation of the option by Microsoft's employees.

We obtain the strike and maturity of surrendered options as follows. Microsoft discloses that the weighted average strike of surrendered options is equal to \$38.70. We deduce the maturity of surrendered options from the stock-and-flow of options section in the 10-K's or 10-Q's, which report the balance of options and their weighted average maturity of options in each strike price bucket. The bucket of options with strike prices from \$33.03 to \$59.56 options (which were surrendered) had average maturities remaining of 4.7 to 4.9 years as of December 2003. However the maturity of the options held by J P Morgan would (mostly) be three years as per the terms of its contract with Microsoft. To obtain volatility, we obtain the prices of all exchange traded options outstanding on Microsoft and compute the implied volatility of these options. Implied volatilities range from 26% to 50% as of the Friday close on December 5, 2003, and vary based on the maturity and strike price. The longest maturity

exchange traded options on Microsoft were two year options with strikes from \$20 to \$30, and these had implied volatilities of 26% to 30% . The historical volatility was higher at 56%. These data provide a range of volatility estimates for computing the value of options surrendered in the Microsoft exchange program.

With an average strike of \$38.72, spot price of \$26.24, a riskless rate of 2.3%, and volatility of 26%, and maturity of 4.7 years, the Black-Scholes value of the average surrendered option equals \$3.31. The employees received, in contrast, an average of \$1.10 per option, which is equal to \$382 million paid by J P Morgan divided by the 344.6 million options surrendered. Thus, the baseline estimates suggest that employees place a 67% discount to Black-Scholes value. The subjective discount is a function of the maturity of the surrendered option: if the maturity were 8 years, the subjective discount would be 80%, while a three year maturity would place the discount at 42%. Assuming the percentage wealth of employees tied to Microsoft is 25%, the \$1.10 subjective value of options implies a relative risk aversion of 4.5 if idiosyncratic volatility were 95% of total volatility. If the idiosyncratic risk were 90% or 85% of total volatility, the relative risk aversion would be 5 and 5.6, respectively. That is, the estimated relative risk aversion that explains the implied discounting in Ingersoll's subjective valuation model increases when we assume a smaller degree of idiosyncratic risk. A significant degree of risk aversion or exposure to company stock is implied in the observed subjective discounting of the employee stock options.

An email communication from Microsoft CEO Steve Ballmer on July 8, 2003 provides additional details about prices of options surrendered in different strike price ranges. Options with strike price of \$33 would command a price of about \$2, while options with \$42 strike price would fetch \$0.60 and options with strike \$45 could be sold for \$0.25. The Black-Scholes option prices for these three strike prices equal \$4.48, \$2.58, and \$2.15. The subjective discounts are 55%, 77%, and 88% for the three options. The subjective discounting of options is quite substantial and increases as the options go out of the money. The finding has strong implications for firms choosing between repricing and non-repricing strategies, as we discuss next.

5. Repricing vs. refresher grants

Companies face underwater options when their stock prices decline. However, repricing has become undesirable in the wake of the 1998 FASB ruling and the related pressures from active institutional shareholders and governance reformists, or because firms explicitly adopt provisions in their compensation plans that restrict repricing. The question is what firms should do if they do not reprice their underwater options. One option is to do nothing and live with the consequences of not repricing, perhaps higher employee turnover (Carter and Lynch 2003, Chidambaran and Prabhala 2003, Chen 2004). However, the empirical fact is that firms have chosen other routes to circumvent the absence of repricing. This section compares repricing to its next-generation alternatives.

A prominent choice is to make a refresher option grant without canceling old underwater options. We discuss this in greater detail below, prior to which we briefly review another strategy used by firms, a “6 and 1” repricing, in which options are canceled on date t and regranted at the spot strike price on date t plus 6 months and 1 day. Another strategy is to make “refresher” option grants without canceling the old underwater options. Both approaches resuscitate losses from options that have gone underwater without the need to start expensing options in financial statements. As we discuss below, repricing dominates both alternatives. One alternative has equal costs but worse incentives. The other alternative is costlier to firms even when constrained to provide equal incentives or value to the repriced employees.

5.1. “6 and 1” repricing

One alternative to straight repricing is the “6 and 1” repricing strategy, in which firms cancel underwater options on date t and commit to grant new options with strike equal to the spot stock price six months and one day after date t . The 6 months and one day

separation between cancelation and regrant ensures that the transaction is not deemed as a repricing under FASB rules. Cost wise, the 6 and 1 repricing is equivalent to a straight strike reset repricing. A “6 and 1” option grant is essentially an at-the-money forward start option, whose cost equals the Black-Scholes cost of a spot at-the-money grant from standard option pricing theory.

From the employee’s viewpoint there are differences between 6 and 1 and straight repricing. One issue is the risk of turnover: the employee must remain with the firm to be awarded the regrant of the canceled option. This risk is significant given the six month delay between option cancelation and the future replacement grant, as pointed out by Murphy (2003). The risk is accentuated by the fact that the repricers already face difficulties from a steep stock price decline and changes its senior management around repricing dates. A second problem with the 6 and 1 repricing is that the strike price of the regranted option is set at the stock price 6 months and a day ahead. This offers little incentive for employees to increase stock prices in the short-term, and ironically may create perverse incentives to push down short-term prices. Other mechanisms and incentives probably limit such value destroying behavior. Our point, however, is that the 6 and 1 approach is dominated by repricing. By one measure, the Black-Scholes cost to firms, it costs the same as repricing, while its incentive properties are definitely worse. There is certainly no economic justification for pushing firms to this dominated alternative compared to straight repricing.

5.2. Quiet repricing via refresher grants

5.2.1. Theoretical framework

An alternative to repricing is to grant fresh at-the-money options as an addition to the repriced executive’s current portfolio of underwater options. This strategy is often needed by firms with self-imposed restrictions on repricing (Chen 2004). After the 1998 FASB rule requiring repricing options to be expensed, the refresher grant strategy is widely used

in lieu of repricing. Ittner, Lambert, and Larcker (2002) document such evidence for new economy firms based on proprietary survey data, and Murphy (2003) reports similar results for EXECUCOMP-based samples after 1998. Hall and Knox (2003) find similar evidence for broader EXECUCOMP samples.

If the quiet repricing involves giving one refresher option for each underwater option, it follows trivially that repricing is cheaper, because repricing at least cancels the old underwater option while the refresher grant approach does not. The interesting question is about the costs of the two strategies when the number of refresher options granted is lower than the number of underwater options. The number could be set, for instance, to be equal to the value that employees would obtain had the company engaged in a straight repricing. Alternatively, it could be set such that the incentives equal the incentives that result from a straight repricing. We show that regardless of the approach used, quiet repricing via refresher grants is strictly *inferior* to conventional strike reset repricing. It costs more to the firm whether we design it so it gives equal value or equal incentives to repriced employees. This Pareto-ranking follows from little more than the nature of the wedge between employees' value and firms' costs of employee stock options, as we discuss below.

Let $BS(S, X)$ denote firms' costs of granting options of strike X when stock price is S and let $V(S, X)$ be its value to employees. Consider repricing an out of the money options with strike X_1 to strike $X_2 (< X_1)$. If we assume options are granted at the money, it follows that $X_2 = S$, today's stock price. Let the cost of repricing to firm be ΔBS_{RP} and the value of repricing to employees be ΔV_{RP} , so that

$$\Delta BS_{RP} = BS(S, S) - BS(S, X_1)$$

$$\Delta V_{RP} = V(S, S) - V(S, X_1)$$

Now consider quiet repricing via new refresher grants. Suppose the firm leaves untouched the out-of-the-money options at strike X_1 and grants nong new options at the money. Suppose the new grant is designed such that the value to the employee is exactly equal to ΔV_{RP} , the value that the employee would have got from repricing. The number of new options n_{NG}

that must be granted solves $n_{NG}V(S, S) = \Delta V$, or $n_{NG} = \frac{\Delta V}{V(S, S)}$. The cost to the repricing firm of making a grant of n_{NG} new options is

$$C_{NG} = n_{NG}BS(S, S) = \frac{\Delta V_{RP}}{V(S, S)}BS(S, S) \quad (1)$$

The cost of quiet repricing via refresher grants exceeds the cost of repricing if and only if $C_{NG} > \Delta BS_{RP}$, equivalently iff $\frac{C_{NG}}{\Delta BS_{RP}} > 1$. Using Equation (1) for C_{NG} , quiet repricing is costlier than conventional repricing if (and only if)

$$\frac{\Delta V_{RP}/V(S, S)}{\Delta BS_{RP}/BS(S, S)} > 1 \quad (2)$$

In other words, quiet repricing is always costlier than straight repricing whenever the subjective value V declines faster than firms' costs of options when options go out of the money. Intuitively, employees attach less value to out of money options than do firms, any contractual arrangement that leaves these underwater options outstanding will cost more to firms than contracts such as repricing that cancel these underwater options. While the above analysis assumes that employee value is held constant whether one reprices or gives new option grants, we note that the results carry through even if we instead equate the subjective incentives from the two alternatives.

5.2.2. “Excessive” dilution entailed by refresher grants

Our analysis provides an economic basis to justify a frequently made argument that making refresher grants is “excessively” dilutive. What this argument does not make clear is whether it is dilutive merely by definition, as would any grant of extra shares, or whether there is an additional economic dilution cost that is being unnecessarily borne by firms. We show support in favor of the latter view.

We can see this argument formally in a straightforward fashion. The number of new options that should be granted by firms to keep the post-grant Black-Scholes value equal to that in repricing is given by the value of n_{BS} that solves the equation $n_{BS}B(S, S) = \Delta BS_{RP}$,

i.e. $n_{BS} = \Delta BS_{RP}/B(S, S)$. n_{BS} represents the size of the grant that the firm would make if it incurred the Black-Scholes cost of repricing. The number of options the firm must give in a refresher grant strategy, n_{NG} , is different, because this number is designed to keep the subjective value of options to employees equal to that attained in repricing. Thus, we have $n_{NG} = \Delta V_{RP}/V(S, S)$ where ΔV_{RP} denotes the change in subjective value from repricing and $V(S, S)$ denotes the subjective value of the repriced option. It follows that n_{NG} exceeds n_{BS} whenever $\Delta V_{RP}/V(S, S) > \Delta BS_{RP}/B(S, S)$. This is, of course, simply a restatement of the condition in Equation (2). In other words, when subjective option values decline faster than Black-Scholes values as options go out of the money, repricing dominates the approach of quiet repricing via extra refresher grants. It is the less dilutive of the two approaches.

5.2.3. *Repricing versus quiet repricing: Numerical example*

From the above discussion, quiet repricing via refresher grants is always costlier than straight repricing. We illustrate the magnitude of these differences through an example and corresponding empirical estimates for our sample. Consider an example in which executive has a 40% out-of-the-money option with a strike of \$100, maturity of 8 years, and the underlying stock trading at a price of \$60 and volatility is 40%. If the executive's relative risk aversion coefficient is 4 and 25% of the executive's wealth is tied to the option issuer's stock and the idiosyncratic risk 90% of the total risk of the stock, the out of the money option is worth \$5.06 to the executive against a Black-Scholes value of \$23.81. Thus, the executive values the option at about 25% of its Black-Scholes value. Suppose the strike is reset to \$60. The executive's valuation of the option is \$8.56, while the Black-Scholes value is \$32.52. Thus, cost to the firm from repricing is \$8.71 ($= 32.52 - 23.81$), while the value to the executive is \$3.50 ($= 8.56 - 5.06$).

More importantly in the above example, the executive option value changes by 69% against a Black-Scholes value change of 36%. There is substantial divergence between the two, suggesting that quiet repricing via refresher grants would be costly to the option granting

firm. This is indeed the case. If the executive were repriced, the value gain to the executive would be \$3.50. Because the executive valuation of each new at-the-money option is \$8.56, the firm needs to give the executive a refresher grant of 0.41 ($= 3.50/8.56$) new options to leave the executive as well off as she would be under straight repricing. The cost of 0.41 new options to the firm is \$13.53 ($= 0.41 \times 32.52$), while straight repricing would have cost the firm \$8.71. Thus, quiet repricing via a refresher grant is 53% costlier than a straight strike reset repricing. The corresponding empirical estimates for our sample are similar. The median cost would be 37% higher had the firm opted for quiet repricing rather than conventional strike reset repricing.

The above examples illustrate the costs of choosing quiet repricing over straight strike reset repricing for hypothetical cases. The costs to shareholders of using such alternatives to repricing are dramatically illustrated in the actual instance of quiet repricing by Microsoft Corporation in the year 2000. We turn to this example next.

5.3. Microsoft Corporation 2000

5.3.1. The cost of quiet repricing

In March 2000, Microsoft Corporation gave stock options grant at a strike price of \$90.625, which we verified as the closing price of the stock on March 6, 2000. The company's stock price experienced a sharp decline after the grant, sending the March 2000 ESO grant underwater. In response, Microsoft granted a refresher grant in April 2000 at a strike price of \$66.625, which was its closing price on April 24, 2000. The new options were granted at a ratio of $\frac{1}{2}$ option for each old option granted, as we verified from Microsoft's proxy statements. We examine the costs of this quiet repricing strategy relative to straight strike reset repricing.

The Black-Scholes value of each out of the money strike \$90.625 option in April 2000 is \$36.77, using the (historical) volatility of 44% and risk-free rate of 5%. At the new strike

price of \$66.625, each option has Black-Scholes value of \$41.83. Had the company repriced, the cost of the repricing would be the value of the new option minus that of the old option canceled, i.e., \$5.06 ($= \$41.83 - \36.77). However, Microsoft chose not to reprice and instead gave new options for each repriced option. The value of this grant per old option outstanding is \$20.66 ($= \41.83). Thus, on a per option basis, the cost of quiet repricing by Microsoft is four times the cost of a straight repricing.

To arrive at the total excess costs of the quiet repricing, we must estimate the excess cost per options by the number of options involved. The total number of refresher options granted in April 2000 is reported in the financial press to be about 70 million (e.g., Ittner, Lambert, and Larcker, <http://www.workindex.com/editorial/whar/whar0109-1.asp> or compensation consultant Graef Crystal's commentary on Microsoft's announcement on Bloomberg on April 25, 2000). Hence, 140 million options represent the original grant being refreshed by the April 2000 grant. This figure accords with Microsoft's own disclosures in its 10-K's, which report 166 million new options in the bucket with strike prices ranging from \$83.29 to \$119.13. Had Microsoft repriced the original options, it would have incurred a cost of \$708 million (140 million options times \$5.06 per option). The quiet repricing related refresher grant cost it \$2,892 million (140 million options times \$20.66 per old option repriced). Quiet repricing through refresher grants, therefore, cost Microsoft shareholders an excess of \$2.1 billion over the cost of straight repricing.

We analyze the sensitivity of our base line estimates with respect to option terms. For example, we assumed that option maturities equal 10 years while effective maturities of options could be lower because of early exercise. Using an effective maturity of 5 years, the differential between straight repricing and quiet repricing is \$1.2 billion. It could also be argued that the year 2000 was an unusual year of extraordinarily high volatility that would not be sustained over a multi-year period, so volatility estimates of 44% could overstate the true volatility. To estimate the volatility, we turn to the portion of Microsoft's 10-K that reports the pro forma earnings estimates if it were to expense employee stock options. This portion uses a volatility estimate of 33% for the year 2000 option grants. Using this

lower volatility estimate and an effective maturity of 5 years, the differential of the cost of Microsoft's quiet repricing over a conventional repricing is \$722 million. Thus, the estimated cost of using the suboptimal contractual structure of a quiet repricing instead of repricing ranges from \$722 million to \$2.1 billion. The estimates are economically significant, and represent a rather steep price to pay to avoid repricing.

5.3.2. *Subjective discounting of options implicit in transaction*

The Microsoft example can be used to recover the extent of subjective discounting of options by employees. Assuming that the offer was designed to leave employees as well off as they would be under a straight repricing, we estimate the implied risk aversion or exposure to company stock for repriced employees. We also conduct this exercise to test whether our assumptions on the drivers of the wedge between employee value and firms' costs of options are conservative. For instance, are employees as risk averse as we assume in our empirical estimates of subjective value?

The subjective Ingersoll (forthcoming) value of an option with strike X at stock price S to an employee, is a function of (among other things) the employee's risk aversion $(\gamma - 1)$ and the fraction of the employee's wealth tied to the firm's stock price (α) . Let this be denoted as $V(S, X; \gamma, \alpha)$. For Microsoft's offer of an additional $\frac{1}{2}$ option at strike $X_2 = \$66.625$ to be equivalent to repricing from strike $X_1 = \$90.625$ to strike $X_2 = \$66.625$, we must have,

$$\begin{aligned} V(S = 66.625, X = 66.625; \alpha, \gamma) &- V(S = 66.625, X = 90.625; \alpha, \gamma) \\ &= \frac{1}{2} V(S = 66.625, X = 66.625; \alpha, \gamma) \end{aligned}$$

that is,

$$\frac{V(S = 66.625, X = 90.625; \alpha, \gamma)}{V(S = 66.625, X = 66.625; \alpha, \gamma)} = \frac{1}{2} \quad (3)$$

For different values of α , the percentage of the executive's wealth tied to Microsoft's stock, we obtain the risk aversion $\gamma^* = \gamma^*(\alpha)$ implied by Equation (3). Clearly this function

is non-decreasing: if a large portion of executive's wealth is tied to a company's stock, a lesser degree of risk aversion is needed to obtain the same subjective option value. For a volatility of 44%, residual volatility of 41%, time to maturity = 9.7 and 10 years for the old and the refresher grants respectively, we find that the value of γ^* exceeds 20 even for high values of wealth tied to company stock, $\alpha = 50\%$. Thus, employee discounting of options implied by the Microsoft refresher grant is very steep. If April 2000 was an unusual month with unduly high volatility, perhaps the volatility input should be lower; also, if executives exercise earlier than 10 years, the maturity could be lower. Using a five year maturity and volatility of 33%, we obtain risk aversion of 9.2 at $\alpha = 10\%$, 3.5 at $\alpha = 25\%$, and 1.64 at $\alpha = 50\%$. Thus, a fairly high degree of subjective discounting, either due to high risk aversion or heavy exposure to Microsoft stock, is implied by the firm's quiet repricing in 2000.

Our above analysis assumes that the subjective value of refresher grants equals the subjective value that would result from repricing. Under this assumption, repricing dominates the refresher grant strategy. However, it is worth noting that the dominance result is far more general. The result can be obtained even if we assume that the firm equates the incentives rather than subjective value from repricing to that from the refresher grant strategy. Even if the objective of the refresher grant is to provide extra incentives to employees, firms are still better off repricing existing underwater options and then incrementally adding extra grants as needed. In other words, firms are always better off substituting as much of the refresher grant as possible with straight repricing. A combination of repricing plus (smaller sized) fresh grants could achieve the same objectives as would be achieved by grants alone at a lower overall cost to firms.

6. Conclusion

Stock options are a dominant form of compensation over the last decade for executives as well as below executive employees (Murphy, 1999). The National Center for Employee

Ownership estimates that there are over 11 million employees covered by over 10,000 stock option plans. A key issue in managing stock option plans is how firms ought to deal with options that go underwater, or out of the money, following steep share price declines. Firms have frequently responded by repricing the underwater options, lowering the strike price of the option to reflect the downturn in stock prices.

The practice of repricing of the stock options has been controversial, and has frequently come in for harsh criticism. As Gillan (2004) writes, “Repricing, however, remains a focal point of shareholder concern, a concern exacerbated by what are perceived to be high levels of potential dilution.” Prominent institutional investors such as CALPERS routinely oppose repricing, by voting against all plans that permit repricing. Institutions have initiated shareholder proposals to eliminate repricing or restrict it by requiring prior shareholder approval. In June 2003, the New York Stock Exchange adopted a rule that treats repricing as a material change in compensation, which requires shareholder approval. Institutional Shareholders Services, a major shareholder voting advisory service, also comes out against repricing, and includes repricing as a undesirable characteristic in computing governance scores for the companies it tracks. The upshot of such pressures, unflattering press, and unfavorable accounting treatment mandated by FASB in 1998, is that the practice of repricing has been rendered comatose since 1998. With the push away from repricing, firms have had to look for other alternatives to handle underwater options, notably the strategy of making “refresher option grants,” as documented by Chen (2004), Ittner, Lambert, and Larcker (2003), Hall and Knox (2003), and Murphy (2003).

Is the suppression of repricing really a positive step in reforming corporate governance? We provide rather sharp evidence that it is *not* so. We make two points in this context. First, the repricing controversy itself appears to be overblown in relation to its economic significance. Using detailed hand collected data on repriced options, we show that repricing costs are rather modest. The portion attributable to executives is even more so because non-executive employees are the primary recipients of repriced option flows, and repricing costs are further moderated by fresh vesting periods frequently associated with repricings.

Our data make it hard to justify the angst expressed by institutional investors and governance reformists over repricing. Repricing is better viewed as a moderate cost vehicle that seems to be targeted at retaining non-executive employees rather than a conduit for wealth expropriation by upper echelons of firms' executives.

Our second point is that restricting firms from repricing merely shifts firms to a regime in which they make refresher grants in lieu of repricing. We show that this shift is strictly socially inefficient. Keeping the subjective value (or incentives) to employees equal to that obtained from repricing, the cost to firms from making equivalent refresher grants is strictly greater than the cost of a straight repricing. Thus, quiet repricing via refresher grants is a Pareto-dominated socially inefficient outcome that merely imposes deadweight costs on firms' shareholders. These costs can be quite substantial when subjective discounting of out of the money options is substantial, as we illustrate in the case of Microsoft Corporation. Had Microsoft adopted straight repricing instead of quiet repricing in April 2000, we estimate that it could have saved its shareholders between \$700 million and \$2.1 billion.

It is important to note that our inefficiency result holds regardless of what motivates firms to reprice. This issue has been extensively addressed in previous work (Brenner, Sundaram, and Yermack (2000), Callaghan, Saly, and Subramanian (2004), Carter and Lynch 2001, Chance, Kumar, and Todd (2000), Chen 2004, Chidambaran and Prabhala 2003). Our point is that irrespective of whether firms reprice to alter option value, option deltas, option vegas, retain employees, or other reasons, our point is that repricing is still better than the regime in which its absence has forced firms to a refresher grant regime to deal with underwater options. This normative economic statement is independent of any particular motivation or test for why firms reprice in the first place.

In conclusion, repricing has been looked at with considerable disfavor, and is often served up as a poster boy for ineffective governance in corporate America. Is the angst over repricing justified? Cross-sectionally, the evidence that repricing is characteristic of ill governed firms is pretty thin. There is little evidence for the view that repricing represents large giveaways to a few entrenched executives. Repricing costs are modest, and in fact, mostly flow to lower

echelons of the repricing firms' hierarchies. On the contrary, constraining repricing, whether through unflattering press, institutional investor pressures, regulatory shifts in accounting standards, or shareholder proposals, appears to be costlier by pushing firms to unambiguously inferior alternatives. In effect, the anti-repricing movement may have successfully created a mountain out of a molehill.

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Table 1: Repricing Announcements by Year

Table 1 reports annual distribution of repricing events reported in EXECUCOMP between 1992 and 1997. Column 1 shows the total number of repricing events. Column 2 shows the number of repricers in the technology, trade, and service industry sectors. . The data comprise 197 executive stock option repricing announcements made between 1992 and 1997.

Year	Repricers	Technology, trade, and service, sectors
1992	13	9
1993	27	21
1994	29	20
1995	41	26
1996	51	35
1997	36	29
1992 - 1997	197	140

Table 2: Terms of Repricing

Table 2 presents details on changes that are made to option terms at the time of repricing. Panel A shows data for change in option moneyness and option maturity. Panel B shows the number of firms that restart vesting periods versus those that do not restart the vesting period and the number of firms that grant fewer options in exchange for options they cancel versus those that grant the same number of options as the cancel. The data comprise 197 executive stock option repricing announcements made between 1992 and 1997. Option terms come from repricing tables in proxy statements or 10-K's of the repricing firm.

	Old options canceled	New options granted	Change
<i>Panel A: Favorable Changes</i>			
Option strike price	\$16.75(41.816)	\$9.000(9.382)	-42.5%(-41.7%)
Option maturity	8.00(7.13)	9.40(8.26)	0(1.27)
<i>Panel B: Unfavorable Changes</i>			
	Yes	No	Inadequate information
Exchange ratio ≥ 1	45	150	2
Vesting period changed	120	59	20

Table 3: Univariate Analysis of Repricing Terms

Table 3 reports the cross sectional characteristics of two groups of firms. Firms that restarted vesting periods are those that initiate a new vesting period for repriced options and firms with no change are those that preserve the vesting status of the old canceled options. Firm specific characteristics includes sales in the prior fiscal year, firm age, and dummies to indicate membership in the high technology, services, and trade industry sectors. We report the median and mean (the number in parentheses) of each characteristic in the table. . The last column reports z and p values for Wilcoxon tests that compare the characteristics between firms that restart vesting periods and firms that preserve the vesting status of old canceled options. The data comprise 197 executive stock option repricing announcements made between 1992 and 1997. Option terms come from repricing tables in proxy statements or 10-K's of the repricing firm.

Variables	Vesting Period		Wilcoxon z(p value)
	Restarted	No change	
Number	119	59	
Strike Price Revision	41.77% (41.79%)	30.77% (34.41%)	2.7(0.01)
% firms with maturity extension	68.24%	17.24%	6.3(0.00)
% with employee wide repricing	87.29%	76.36%	1.8(0.07)
% with CEO Turnover	30.25%	18.64%	1.65(0.10)
% of technology firms	45.38%	25.42%	2.56(0.01)
Sales [-1](\$ million)	314.7(694.0)	406.3(969.0)	-1.57(0.11)
Firm age (months)	83(114.2)	83(110.7)	-0.25(0.80)

Table 4: Probit Estimates of Vesting Restarts

Table 4 reports the results of a Probit model in which the dependent variable is equal to 1 if the repriced options are subject to a new vesting period and/or new exercise restrictions. Independent variables include dummies for vesting restarts and maturity extensions, the percent change in the strike price, dummies for membership in the high technology, services, and trade industry sectors, the logarithm of sales in the fiscal year prior to the repricing fiscal year, and the age of the firm in months. Numbers in parenthesis denote t-statistics, superscript *a* denotes significance at the 1% level, and superscript *b* denotes significance at the 10% level. The data comprise 197 executive stock option repricing announcements made between 1992 and 1997. Option terms come from repricing tables in proxy statements or 10-K's of the repricing firm.

Independent Variables	Coefficient(t-statistic)
Intercept	-2.18 ^a (-2.90)
% Strike price revision	1.62 ^a (2.05)
Maturity extended	1.81 ^a (6.67)
Employee-wide	0.98 ^a (2.99)
CEO Turnover	0.47 ^b (1.61)
Technology firm	0.62 ^a (2.20)
Log (prior year sales)	-0.009(-0.10)
Firm age (months)	0.001(0.72)

Table 5: Flow of Repriced Options

Table 5 reports the flow of repriced options across the hierarchy of the repriced firm. Column 2 shows the median (mean) number of executives' options that are repriced as reported in the repricing tables in the proxy statements of the repricing firm. Column 3 shows the median (mean) sum of the options repriced for all employees. Column 4 reports the median (mean) ratio of options repriced for non-executive employees as a percentage of total options repriced by the firm. The data comprise 197 executive stock option repricing announcements made between 1992 and 1997.

Year	Sum of executive options repriced	Sum of all options repriced by firm	% of repriced options held by below executive employees
1992	206,628(253,789)	368,016(1,256,612)	20.52%(36.51%)
1993	101,370(364,453)	477,925(676,471)	69.66%(62.58%)
1994	83,544(209,193)	208,954(533,235)	56.55%(52.75%)
1995	107,315(247,965)	375,323(593,634)	63.02%(59.97%)
1996	103,674(232,270)	485,336(857,732)	73.04%(58.97%)
1997	177,000(387,563)	785,563(1,575,370)	75.32%(68.71%)
1992 - 1997	117,895(280,843)	431,314(898,028)	67.74%(59.59%)

Table 6: Black-Scholes Costs of Repricing

Table 6 reports the Black-Scholes value of executive stock options before and after repricing, the change in Black-Scholes value, and the change in the Black-Scholes value as a percentage of the Black-Scholes value of the options that were canceled. Column 2 reports the median (mean) value of repricing cost per named executive. Columns 3-5 report the median (mean) total repricing costs per firm from repricing options held by top named executives, other executives, and all executives in the firm. Column 6 reports the median (mean) firm wide repricing costs for all employees. The data comprise 197 executive stock option repricing announcements made between 1992 and 1997. Option terms come from repricing tables in proxy statements or 10-K's of the repricing firm.

	Per executive	Named executives (per firm)	Other executives (per firm)	All executives (per firm)	All employees (per firm)
Total observations	946	163	77	163	155
Black-Scholes value before repricing	209,000 (468,598)	1,173,008 (2,362,546)	395,591 (755,837)	1,340,750 (2,719,598)	4,379,768 (9,924,536)
Black-Scholes value after repricing	264,556 (621,600)	1,560,121 (3,183,221)	474,960 (902,546)	1,703,593 (3,609,577)	5,584,039 (12,317,447)
\$ change in Black-Scholes value	44,929 (153,001)	292,082 (820,675)	84,114 (146,708)	317,044 (887,970)	1,107,414 (2,392,910)
% Change in Black-Scholes value	25.38% (113.73%)	25.71% (136.79%)	25.18% (136.79%)	23.78% (51.01%)	- -

Table 7a: Subjective Valuation of Repriced Options

Table 7a reports the subjective Ingersoll (2002) value of executive stock options before and after repricing, the change in subjective value due to repricing, and the change in value as a percentage of the value of options canceled. Column 2 reports the median (mean) subjective value of repricing per named executive. Columns 3-5 reports the median (mean) total repricing benefits per firm from repricing options held by top named executives, other executives, and all executives in the firm. Column 6 reports the median (mean) subjective value of total repriced options held by all employees in the firm. The data comprise 197 executive stock option repricing announcements made between 1992 and 1997. Option terms come from repricing tables in proxy statements or 10-K's of the repricing firm. Ingersoll model values are calculated using historical volatility, the residual risk from a market model, relative risk aversion equal to 4, and assuming that 25% of the employee wealth is tied to the repricing firm's stock price and that the repricers do not pay dividends.

	Per executive	Named executives (per firm)	Other executives (per firm)	All executives (per firm)	All employees (per firm)
Total observations	946	163	77	163	155
Subjective value before repricing	12,255 (56,744)	76,480 (288,766)	22,278 (84,072)	85,539 (328,207)	283,759 (1,017,425)
Subjective value after repricing	18,720 (84,273)	104,381 (435,082)	33,903 (110,817)	128,761 (487,070)	424,056 (1,468,339)
Dollar change in subjective value	5,384 (27,528)	32,435 (146,679)	7,842 (26,744)	36,569 (158,862)	124,434 (451,384)
Percent change in subjective value	48.21% (98.48%)	48.27% (109.12%)	51.31% (81.64%)	45.52% (64.51%)	- -

Table 7b: Incentive Effects

Table 7b reports the Black-Scholes deltas and subjective deltas of executive stock options before and after repricing, and the change in option delta. Column 2 reports the median (mean) value of Black-Scholes delta values. Column 3 reports the median (mean) of Ingersoll (2002) subjective valuation model values. The data comprise 197 executive stock option repricing announcements made between 1992 and 1997. Option terms come from repricing tables in proxy statements or 10-K's of the repricing firm. Ingersoll model values are calculated using historical volatility, the residual risk from a market model, relative risk aversion equal to 4, and assuming that 25% of the employee wealth is tied to the repricing firm's stock price and that the repricers do not pay dividends.

	Black-Scholes		Subjective	
	Executives	Employees	Executives	Employees
	(Options & Stock)	(Only Options)	(Options & Stock)	(Only Options)
Total Observations	140	163	140	163
Delta before repricing	730,138 (1,554,503)	215,020 (393,816)	289,624 (1,198,930)	7,670 (33,923)
Delta after repricing	755,858 (1,629,321)	266,640 (476,617)	318,867 (1,230,917)	14,155 (64,023)
Change in Delta	30,429 (74,817)	29,772 (82,801)	8,054 (31,986)	7,152 (30,100)
%Change in Delta	4.29% (8.51%)	12.57% (22.32%)	3.09% (28.60%)	71.18% (116.19%)

Table 8: Model Parameters, Repricing Value, and Incentive Effects

Table 8 reports the median (mean) subjective Ingersoll (2002) value and delta changes of repriced executive stock options caused by repricing as a function of the executives' risk aversion level (relative risk aversion = $-(\gamma - 1)$) and the percentage of employee wealth (α) exposed to stock prices. The data comprise 197 executive stock option repricing announcements made between 1992 and 1997. Option terms come from repricing tables in proxy statements or 10-K's of the repricing firm. Ingersoll model values are calculated using historical volatility, the residual risk from a market model, relative risk aversion equal to 4, and assuming that 25% of the employee wealth is tied to the repricing firm's stock price and that the repricers do not pay dividends.

Panel A: % Value Changes			
	$\gamma = -2$	$\gamma = -3$	$\gamma = -4$
$\alpha = 25\%$	37.74%(57.90%)	45.52%(64.42%)	49.02%(73.90%)
$\alpha = 50\%$	59.93%(92.51%)	72.39%(138.54%)	81.86%(158.95%)
$\alpha = 75\%$	84.54%(165.01%)	101.49%(203.79%)	106.46%(295.71%)
Panel B: % Delta Changes			
	$\gamma = -2$	$\gamma = -3$	$\gamma = -4$
$\alpha = 25\%$	31.79%(50.40%)	40.65%(61.29%)	49.19%(72.89%)
$\alpha = 50\%$	57.16%(85.47%)	71.18%(116.20%)	83.42%(177.23%)
$\alpha = 75\%$	79.7%(136.73%)	93.29%(201.71%)	117.49%(406.52%)

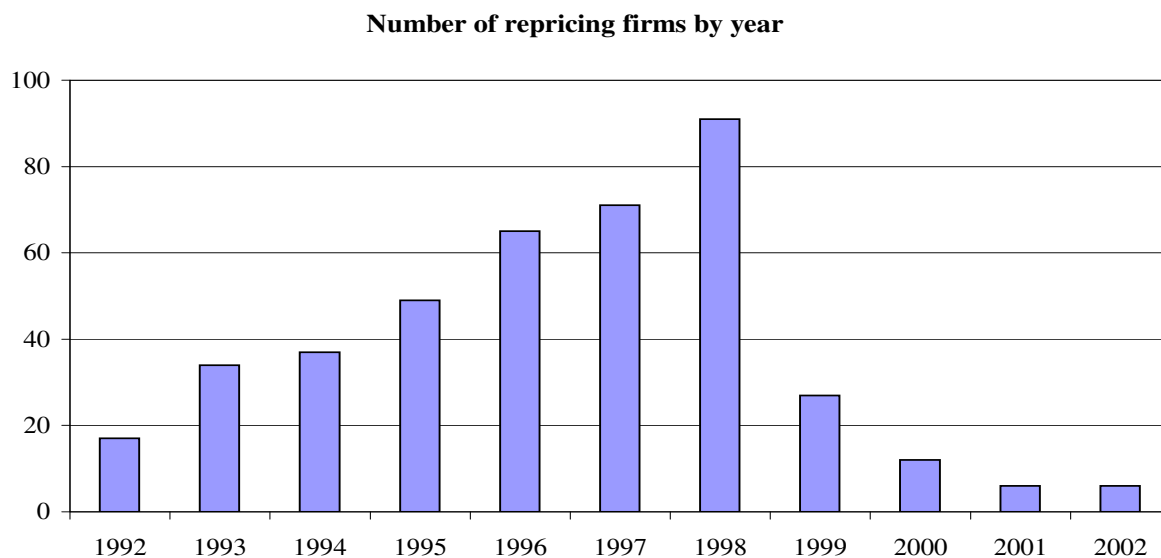


Fig. 1. Number of firms in EXECUCOMP with at least one repriced executive in a fiscal year (i.e. `PREPRICE = "TRUE"`). Fiscal year t equals calendar year t if the year end is between June and December and calendar year $t-1$ otherwise. Thus, the 1999 data includes repricing for firms with fiscal years beginning between June 1998 and May 1999, which spans a sub-period before the December 1998 FASB change in repricing accounting.